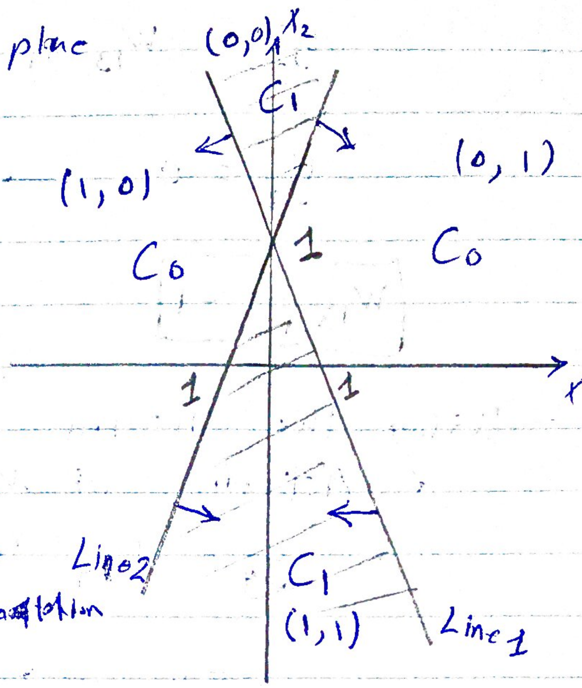
✓

$\frac{10}{10}$

Section 2 محمد إبراهيم محمد عبد الخميسى سعدة

- Chosing The orientation shown in X_1-X_2 plane



- Line 1 $\rightarrow$ (0,1) , (1,0)

$$\frac{X_1 - 0}{X_2 - 1} = \frac{1 - 0}{0 - 1}$$

$$-X_1 = X_2 - 1$$

$$X_1 + X_2 - 1 = 0$$

testing the orientation using (0,0)

$\hookrightarrow$ negative $\rightarrow$ Changing the orientation

$\boxed{-X_1 - X_2 + 1 = 0}$ Line 1

- Line 2 $\rightarrow$ (0,1) , (−1,0)

$$\frac{X_1 - 0}{X_2 - 1} = \frac{0 - (-1)}{1 - 0}$$

$$X_2 - 1 = X_1$$

$$X_1 - X_2 + 1 = 0$$

testing the orientation using (0,0)

$\hookrightarrow$ positive

$\boxed{X_1 - X_2 + 1 = 0}$ Line 2

- We have two sepration Lines
- So we need ~~to~~ to two neurons in the hidden Layer

- using the neuron N3 to represent the Line 1
  * Activation of N3

$$y_3 = W_{13} X_1 + W_{23} X_2 + W_{03}$$

$$y_3 = 0 \rightarrow \boxed{-X_1 - X_2 + 1 = 0}$$

$\boxed{W_{13} = -1}$ $\boxed{W_{23} = -1}$ $\boxed{W_{03} = 1}$

- Using the neuron N4 to represent the Line 2
  * Activation of N4

$$y_4 = W_{14} X_1 + W_{24} X_2 + W_{04}$$

$$y_4 = 0 \rightarrow \boxed{X_1 - X_2 + 1 = 0}$$

$\boxed{W_{14} = 1}$ $\boxed{W_{24} = -1}$ $\boxed{W_{04} = 1}$

- to provide the required Classification with the Choosen orientation, we need to perform XNOR operation on the output of neurons N3, N4

- We Design AND Gate Using neuron N5

- Activation of N5

$$y_5 = W_{35} f(y_3) + W_{45} f(y_4) + W_{05}$$

$f(y_3)$	$f(y_4)$	$f(y_3) \cdot f(y_4)$	S
0	0	0	1
0	1	0	0
1	0	0	0
1	1	1	1

- for $f(y_3) = 0$, $f(y_4) = 0$

$y_5 = \boxed{W_{05} < 0}$

- for $f(y_3) = 0$, $f(y_4) = 1$

$y_5 = \boxed{W_{45} + W_{05} < 0}$

- for $f(y_3) = 1$, $f(y_4) = 0$

$y_5 = \boxed{W_{35} + W_{05} < 0}$

- for $f(y_3) = 1$, $f(y_4) = 1$

$y_5 = \boxed{W_{35} + W_{45} + W_{05} > 0}$

We Choosing $\rightarrow$ $\boxed{y_5 = f(y_3) + f(y_4) - 1.5}$

$\boxed{W_{35} = 1}$ $\boxed{W_{45} = 1}$ $\boxed{W_{05} = -1.5}$

The Activation of neuron N6

$$y_6 = W_{36} f(y_3) + W_{46} f(y_4) + W_{56} f(y_5) + W_{06}$$

$\rightarrow$ for $f(y_3) = 0$, $f(y_4) = 0$ $\rightarrow f(y_5) = 0$ $\rightarrow S = 1$

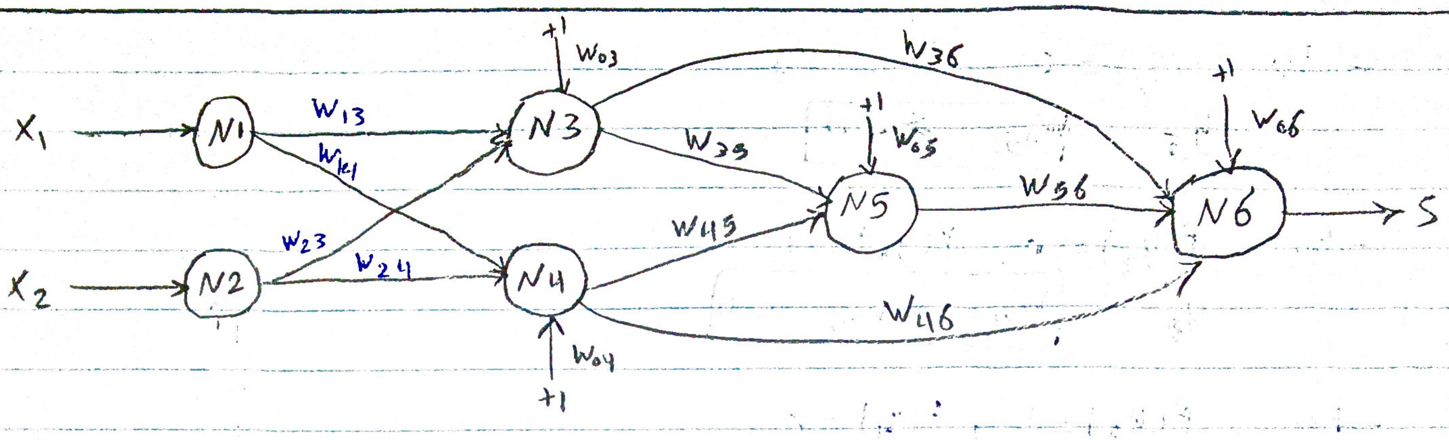
$y_6 = \boxed{W_{06} > 0}$

$\rightarrow$ for $f(y_3) = 0$, $f(y_4) = 1$ $\rightarrow$ $f(y_5) = 0$ $\rightarrow S = 0$

$y_6 = \boxed{W_{46} + W_{06} < 0}$

$\rightarrow$ for $f(y_3) = 1$, $f(y_4) = 0$ $\rightarrow f(y_5) = 0$ $\rightarrow S = 0$

$y_6 = \boxed{W_{36} + W_{06} < 0}$



using Binary threshold Function for hidden and output neurons

→ for $f(y_3) = 1$, $f(y_4) = 1$ → $f(y_5) = 1$ → $S = 1$

$$y_6 = \boxed{W_{36} + W_{46} + W_{56} + W_{06} > 0}$$

We choose → $\boxed{y_6 = -1.5\, f(y_3) - 1.5\, f(y_4) + 2.5\, F(y_5) + 1}$

$\boxed{W_{06} = 1}$ $\boxed{W_{36} = -1.5}$ $\boxed{W_{46} = -1.5}$ $\boxed{W_{56} = 2.5}$

X_1	X_2	y_3	$f(y_3)$	y_4	$f(y_4)$	y_5	$f(y_5)$	y_6	$S=f(y_6)$	Classification
0	2	-1	0	-1	0	-1.5	0	1	1	C_1
0	-2	3	1	3	1	0.5	1	0.5	1	C_1
2	1	-2	0	2	1	-0.5	0	-0.5	0	C_0
-3	0	4	1	-2	0	-0.5	0	-0.5	0	C_0

- No, we can't classify (1, 2) → because it lays on the Line 2

$$X_1 - X_2 + 1 = 1 - 2 + 1 = 0$$